

Water Resources of Fort Huachuca Military Reservation, Southeastern Arizona

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CONTRIBUTIONS TO THE HYDROLOGY OF THE UNITED STATES

GEOLOGICAL SURVEY WATER-SUPPLY PAPER 1819-D

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WATER RESOURCES, FORT HUACHUCA, ARIZONA

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TABLE 1.—Drillers' logs of wells near Fort Huachuca, Ariz.—Continued

Stratigraphic unit	Rock description	Thickness (ft)	Depth (ft)
(D-21-20)35a			
[Post well 4. Altitude: 4,810 ft]			
Terrace deposit and upper unit of basin fill (undivided)	Gravel and adobe	67	67
	Adobe and boulders	230	297
	Sand, gravel, boulders, and adobe	149	446
	Clay	7	453
	Gravel and clay	34	487
	Sand and clay	95	582
	Sand	35	617
Lower unit of basin fill	Cemented sand	100	717
	Sand with thin clay layers	45	762
	Sand and gravel	15	777
	Coarse sand	70	847
Pantano(?) Formation of Brennan (1957, 1962)	Cemented sand and gravel	65	912
(D-31-20)88dbb			
[Post well 6. Altitude: 4,645 ft]			
Terrace deposit	Bouldery loose fill	32	32
	Sand and gravel	8	40
	Caving sand and gravel	5	45
Upper unit of basin fill	Bouldery red clay	30	75
	Gravel	8	83
	Gravelly red clay	267	350
	Caving gravelly red clay	42	392
Lower unit of basin fill	Sandy red clay	19	411
	Bouldery red clay	9	420
	Tight sandy red clay, first strong water at 492 ft	72	492
	Tight sandy red clay, grading into conglomerate	78	570
Pantano(?) Formation of Brennan (1957, 1962) (samples from 815 ft to bottom of hole are characteristic of lower Tertiary unit; no samples were collected above 815 ft)	Conglomerate	32	602
	Indications of water in break zone	2	604
	Conglomerate	6	610
	Indications of water in break zone	6	616
Pantano(?) Formation of Brennan (1957, 1962) (samples from 815 ft to bottom of hole are characteristic of lower Tertiary unit; no samples were collected above 815 ft)	Conglomerate	142	758
	Very hard conglomerate	13	771
	Conglomerate	114	885
	Very hard conglomerate	35	920
Pantano(?) Formation of Brennan (1957, 1962) (samples from 815 ft to bottom of hole are characteristic of lower Tertiary unit; no samples were collected above 815 ft)	Conglomerate	105	1,025
	Little sand in crevices, indications of water	13	1,038
	Conglomerate	62	1,100
	Conglomerate, little redder in color	50	1,150
Pantano(?) Formation of Brennan (1957, 1962) (samples from 815 ft to bottom of hole are characteristic of lower Tertiary unit; no samples were collected above 815 ft)	Mudstone or reddish shale	13	1,163
	Conglomerate	27	1,190
	Hard conglomerate with soft ribs of coarse sandstone cemented with limy material	40	1,230

D12 CONTRIBUTIONS TO THE HYDROLOGY OF THE UNITED STATES

TABLE 1.—Drillers' logs of wells near Fort Huachuca, Ariz.—Continued

Stratigraphic unit	Rock description	Thickness (ft)	Depth (ft)
(D-21-21)7bed [Altitude: 4,265 ft]			
Terrace deposit and upper unit of basin fill (undivided)	Red clay with varying quantities of sand and gravel.....	300	300
(D-22-22)2bbb, [Unused post well. Altitude: 4,641 ft]			
Terrace deposit and upper unit of basin fill (undivided)	Adobe with hard boulders.....	90	90
	Loose gravel, dry.....	8	98
Lower unit of basin fill	Adobe with hard boulders.....	374	470
	Hard sandstone, first showing of water at 471 ft.....	1	471
	Sand and gravel, compacted.....	15	489
	Loose sand, gravel, and boulders.....	133	622
(D-22-22)8bbb, [Post well 1. Altitude: 4,041 ft]			
Terrace deposit	Adobe.....	8	8
7	Boulder bed.....	19	27
	Adobe and boulders.....	61	88
	Sand, gravel, and boulders.....	24	112
	Adobe and boulders.....	58	170
Upper unit of basin fill	Loose boulders, very hard.....	86	256
	Adobe, gravel, and boulders.....	16	272
	Adobe, sand, gravel, and boulders.....	47	319
	Boulders, very hard, and clay.....	46	365
	Adobe and gravel.....	52	417
	Hard sand and gravel, cemented.....	9	428
	Adobe, sand, and gravel.....	39	465
	Hard sand.....	4	469
	Water, gravel, and sand.....	1	470
	Sand and gravel.....	18	488
	Loose sand and gravel, strong showing of water at 488 ft.....	36	524
	Hard sand, gravel, and boulders.....	21	545
Lower unit of basin fill	Loose sand and gravel.....	35	580
	Loose boulders.....	11	591
	Loose water sand and gravel.....	24	615
	Loose sand, gravel, and boulders.....	5	620
	Hard boulders.....	9	629
	Loose sand and boulders.....	16	645
	Hard sand.....	10	655
	Loose sand and gravel.....	25	680
Pantano(?) Formation of Brennan (1957, 1962)	Adobe (probably weathered zone or soil developed on top of lower Tertiary unit).....	12	692
	Hard drilling, apparently drilling in rock.....	9	701

WATER RESOURCES, FORT HUACHUCA, ARIZONA

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TABLE 1.—Drillers' logs of wells near Fort Huachuca, Ariz.—Continued

Stratigraphic unit	Rock description	Thickness (ft)	Depth (ft)
(D-22-20) 4aaa			
[Post well 2. Altitude: 4,841 ft]			
Terrace deposit and upper unit of basin fill (undivided)	Conglomerate, medium hard.....	40	40
	Clay and gravel.....	20	60
	Sandstone and conglomerate, medium hard.....	70	130
	Conglomerate, medium hard.....	70	200
	Conglomerate with hard strata.....	70	270
	Conglomerate, medium.....	25	285
	Conglomerate with soft strata.....	15	310
	Conglomerate, medium.....	30	340
	Sand.....	30	370
	Large boulders.....	40	410
	Sand and gravel.....	30	440
	Water sand conglomerate.....	37	477
	Conglomerate with lots of water.....	43	520
	Gravel carrying water.....	20	540
Lower unit of basin fill	Hard conglomerate.....	30	570
	Sand conglomerate with water.....	50	620
	Conglomerate, medium, with hard strata.....	30	650
	Hard conglomerate.....	40	690
Pantano(?) Formation of Brennan (1957, 1962)	Rock.....	20	710

in thickness. The bedding is tabular to lenticular; crossbedding is uncommon, but many flat pebbles are imbricated. Local unconformities that separate groups of beds in the formation may reflect continual uplift and tectonic unrest coincident with deposition of the conglomerate. Both the local inclusion of landslide material and the large size of the boulders in the Pantano(?) are suggestive of high relief, possibly due to concurrent uplift, in the source area. The formation is firmly cemented; in most exposures individual cobbles can be broken out of the fresh rock, but in many places the cementation is so strong that the rock breaks indiscriminately across cobbles and matrix.

The pebbles and larger fragments are, in approximate order of abundance, pinkish-gray to pale-red rhyolitic welded tuff, gray to pinkish-gray felsitic welded tuff, grayish-purple andesite, reddish-brown to very dark red shale and siltstone, light-yellow granite, greenish-gray epidotized and chloritized andesite, dark-gray limestone, and light-gray to white quartzite. Most of the coarse material is sharply angular, but some pebbles and cobbles show slight rounding, especially in outcrops farthest from the Huachuca Mountains.

TEST WELL # 5

FORT HUACHUCA

Feet

0.0	Silty sand, tannish brown, loose to firm, dry
0.8	Gravelly sand, tannish brown, firm, dry
6.0	Silty sand, light reddish brown, firm, dry
10.0	Silty sand, tan, firm, dry
14.0	Silty gravelly sand, tan, firm, dry
16.0	Silty gravelly sand, tannish brown, firm, dry
18.0	Cobbles
25.0	Silty gravelly sand, reddish brown, loose to firm, dry
30.0	Silty sand, reddish brown, loose to firm, dry
37.0	Cobbly sand, reddish brown, firm, dry
38.0	Silty sand, reddish brown, loose, dry
53.0	Clayey sandy gravel, brown
55.0	Clayey sand with scattered fragments mudstone
58.5	Gravelly sand, medium to coarse
59.5	Clayey sand
63.5	Gravelly sand
75.0	Clayey gravelly sand
93.0	Gravelly clayey sand
97.0	Sandy clay
102.0	Sandy gravel
105.0	Sandy clay
130.0	Sandy gravel
143.0	Sandy clay
163.0	Sandy gravel

171.0	Sandy clay
183.5	Gravelly sand
185.5	Sandy clay
190.0	Clayey sand, sand fine
192.5	Sandy clay, brown sand
198.0	Gravelly sand, sand medium to coarse
203.0	Sandy clay, brown
205-207.5	Sand fine to medium
224.0	Gravelly sand
228.0	Clayey sand, fine to medium
235.5	Sandy silty clay, brown
241.0	Clayey silty sand, brown
245.5	Gravelly sand
248.5-249.5	Clayey sand, brown
254.5	Gravelly sand
261.5	Clayey sand, fine to medium
261.5	Clayey sand, fine to medium
279.0	Sandy silty clay, brown
290.0	Sandy silty clay, brown
316.0	Sandy gravel
326.0	Silty sandy clay, clay brown
342.0	Clayey sand
352.0	Sandy gravel
373.0	Clayey sandy gravel
394.0	Clayey sand, brown, fine to medium
395.5	Gravelly sand, sand medium to coarse

401-402.5	Sandy silty clay, brown
408.5	Clayey silty sand
410.0	Clayey gravelly sand
461.0	Gravelly sand, sand medium to coarse
535.5	Clayey sand, brown, fine to coarse
538.0	Clayey gravelly sand, sand fine to coarse
552.0	Gravelly sand with traces of clay
565.0	Gravelly sand, sand fine to coarse
800.0	Gravelly sand, sand fine to coarse

Fort Huachuca, Arizona
Geologic Log
Test Well No. 6

- 0.0 Terrace deposits
Gravelly sandy clay, reddish brown, moderately plastic, dry, sand and gravel are angular to rounded, maximum size 2-1/2 inches, sand is fine to medium, mostly fine.
- 1.6 Caliche with sand and gravel, reddish gray.
- 4.6 Sand, brown, fine grained, well sorted, clean, abundant mica.
- 15.0 Sand is slightly lighter brown color, angular to rounded.
- 30.0 Sand is light brown to gray, few medium size grains.
- 44.0 Sand is fine to medium grained, trace of tan clay.
- 62.0 Upper Unit of Basin Fill
Sand, medium brown, fine to medium grained, angular to rounded, clay content varies from 0 to 10 percent.
- 67.0 Sandy clay, tan, moderately plastic, about 30 percent fine to medium grained, angular to rounded sand.
- 70.0 Clayey sand, tan, fine to medium grained, some caliche, clay content variable, generally 30 to 40 percent, moderately plastic.
- 101.0 Sandy clay, tan, moderately plastic, sand content varies from 15 to 30 percent, fine to medium grained.
- 103.0 Clayey sand, fine to coarse, 30 to 40 percent tan moderately plastic clay.
- 105.0 Sandy clay as at 101.0 feet.
- 138.0 Sand, fine to medium grained, angular to rounded, well graded, numerous maroon colored grains, trace of tan clay.
- 147.0 Sandy clay, tan, moderately plastic, 20 to 35 percent fine to medium sand.
- 158.0 Clayey sand, fine to coarse, angular to rounded; clay is tan, moderately plastic, clay content variable from 10 to 40 percent.

INCLOSURE 5, SHEET 1

Test Well No. 6 (cont'd)

- 189.0 Sandy clay, tan, moderately plastic, 10 to 30 percent fine to coarse sand.
- 195.0 Sand, fine to medium, angular to rounded, mostly dark brown and maroon, trace of tan clay.
- 208.0 Sandy clay-clayey sand; about equal amounts of moderately plastic, tan clay and fine to coarse grained, angular to subrounded sand.
- 230.0 Lower Unit of Basin Fill
Clayey sand, fine to medium with few coarse grains, more volcanics than above, angular to subround, about 40 percent tan clay.
- 250.0 Sandy clay, similar to 230.0 feet with a predominance of tan clay, 30 to 40 percent fine to medium sand.
- 258.0 Sand, fine to medium grained, scattered coarse grains, angular to subround, trace of tan clay
- 262.0 Clayey sand, fine to coarse, angular to subround, 10 to 30 percent tan clay.
- 268.0 Sand, fine to coarse, trace of tan clay.
- 272.0 Clayey sand as at 262.0 feet.
- 282.0 Sand, fine to medium grained, scattered coarse grains, angular to rounded, 5 to 15 percent brown, moderately plastic clay, scattered streaks of clay.
- 335.0 Clayey sand, fine to medium grained, clay content varies from 15 to 30 percent.
- 345.0 Clayey sand as at 335.0 feet with scattered small gravel fragments.
- 264.0 Clay content decreases to less than 5 percent.
- 378.0 Clayey sand-sandy clay, about equal amounts of brown clay and fine to medium grained sand.
- 390.0 Clayey sand, fine to medium with few coarse grains, 10 to 15 percent moderately plastic brown clay. Thin clay streak at - 401.

INCLOSURE 5 SHEET 2

Test Well No. 6 (cont'd)

410.0 Sand, mostly fine to medium grained, mostly angular, clay content varies from 0 to 10 percent; most of sand grains are dark brown and maroon, looks like reworked Pantano Formation.

490.0 Sand as at 410.0 feet with scattered small gravel fragments.

550.0 Pantano Formation.

Sand, fine to medium with few coarse grains, angular to subround, most grains are brown, maroon, green, mostly volcanic rocks, cuttings have been ground up by drilling, slightly to moderately cemented becoming harder with depth. Little change in cuttings from 550.0 to bottom of well; drilling time increases slightly.

1004.0 Bottom of well

INCLOSURE 5 SHEET 3

USFH-00002911

Fort Huachuca, Arizona
Geologic Log
Test Well No. 7

- 0.0 Terrace deposits
Clayey sand, reddish brown, sand is mostly fine to medium, some coarse, angular to subround, variable amount of lean clay.
- 3.5 Clayey Sand as above with scattered small gravel, 10 to 20 percent reddish brown clay.
- 20.0 Sand, mostly fine to medium grained, few coarse grains, angular to subround, trace to 5 percent reddish brown clay.
- 52.0 Upper Unit of Basin Fill
Sand, mostly medium to coarse, angular to subround, trace of brown clay.
- 93.0 Clayey sand, fine to coarse angular to subround sand with 20 to 30 percent brown, moderately plastic clay.
- 105.0 Sand is fine to medium grained, 10 to 20 percent brown clay.
- 130.0 Clayey sand as above, 20 to 30 percent brown clay.
- 150.0 Clayey sand as above, 30 to 40 percent clay.
- 158.0 Sand, fine to medium, angular to subround, less than 5 percent clay.
- 164.0 Sandy clay, brown, moderately plastic, 30 to 40 percent fine to medium grained sand.
- 181.0 Clayey sand, fine to medium grained. Few coarse grains, 30 to 40 percent brown, moderately plastic clay.
- 198.0 Sandy clay-clayey sand, cuttings are mixture of fine to medium sand and brown clay in varying proportions, probably layers of sand and sandy clay.
- 215.0 Lower Unit of Basin Fill
Sandy clay, brown, moderately plastic, 10 to 20 percent fine to medium sand.

INCLOSURE 5 SHEET 4

Test Well No. 7 (Cont'd)

- 245.0 Thin layer of fine to medium sand, may be slightly clayey.
- 248.0 Sandy clay as at 220.0 feet.
- 263.0 Sand, fine to coarse, angular to subround, mostly medium to coarse, trace of brown clay.
- 279.0 Clayey sandy gravel, gravel is fine, subangular to rounded, sand is fine to coarse, 10 to 20 percent brown, moderately plastic clay.
- 284.0 Sand, fine to medium, mostly fine, angular to subrounded, trace of brown clay.
- 289.0 Sandy clay, brown, moderately plastic
- 294.0 Sand, fine to medium with few coarse grains angular to subround, variable amount of brown clay
- 315.0 Clayey sand, same as at 294.0 feet with 10 to 15 percent brown clay.
- 330.0 Sand, fine to medium, angular to subround, few coarse grains, trace to about 5 percent brown clay, may be thin layers of clay or clayey sand.
- 431.0 Thin streaks of clayey sand, sand is fine to medium coarse.
- 436.0 Sand as at 330.0 feet.
- 450.0 Clayey sand, fine to medium, angular to subangular few coarse grains, trace to 10 percent brown clay.
- 463.0 \pm 15 percent light brown clay.
- 485.0 Clayey sand as at 450.0 feet.
- 510.0 Slight increase in number of dark brown and maroon sand grains, continues to increase with depth, decrease in quartz grains.
- 551.0 Sand, fine to medium, few coarse grains, angular to subrounded, clean, darker grains continue to increase (looks like reworked Pantano Formation).

INCLOSURE 5 SHEET 5

Test Well No. 7 (Cont'd)

590.0 Hard streaks caused by cementation, becomes more cemented with depth.

635.0 Pantano Formation

Sand, fine to coarse, angular to subround, scattered gravels and cobbles, mostly dark colored grains, dark green, dark gray, brown, maroon, overall brown color, slightly to moderately cemented, slight increase in cementation and hardness with increasing depth.

700.0 A few zones are softer, overall moderately cemented.

750.0 Cuttings are fine to medium grained, formation is harder, moderately well cemented, scattered softer zones.

1002.0 Bottom of hole

Fort Huachuca, Arizona
Geologic Log
Test Well No. 8

- 0.0 Terrace deposits
Sandy clay, reddish brown, moderately plastic, small amount fine to coarse sand.
- 1.0 Clayey, gravelly sand, fine to coarse with small gravel, angular, 30 to 40 percent reddish brown lean clay.
- 3.5 Sandy clay, reddish brown lean clay as above, 15 to 20 percent, mostly fine, sand.
- 5.0 Clayey sand, mostly fine to medium grained, few coarse grains and scattered gravel, angular to subround, 10 to 20 percent reddish brown lean dry clay, few streaks of caliche.
- 13.0 Sand, fine to coarse grained, angular to subround; thin streaks of hard sandy clay 16 to 20 feet.
- 35.0 Upper Unit of Basin Fill
Sand, mostly fine to very fine, slightly cemented.
- 40.0 Clayey sand, fine to medium sand with 5 to 15 percent reddish brown clay.
- 44.0 Clayey sand, fine to medium coarse, well graded.
- 46.0 Sand, fine to coarse, angular to subround, trace of clay.
- 57.0 Gravelly sand, fine to coarse sand with about 40 percent 1/4 to 3/8-inch gravel, angular to subangular, few rounded, gravel content decreasing from 59.0 feet.
- 60.0 Sand, fine grained, contains scattered gravel, Coarser grained with more gravel at 70.0 feet.

INCLOSURE 5 SHEET 7

Test Well No. 8 (Cont'd)

- 72.0 Gravelly sand, fine to coarse angular sand with 30 to 40 percent angular to subround gravel, trace of clay.
- 85.0 Sand, fine to coarse, mostly angular scattered small gravel; thin streaks of sandy clay 94.0 to 97.0 feet.
- 97.0 Clayey sand, sand as at 85.0 feet with 5 to 10 percent brick red to brown clay. Clay content decreases below 105 feet.
- 107.0 Sand, fine to medium grained, finer at 116.0 feet, trace of clay. Clay content 5 to 10 percent at 118 feet.
- 120.0 Sand as at 107 feet with thin layers of clayey sand, clay content 5 to 15 percent.
- 140.0 Clayey sand-sandy clay, about equal amounts of fine to medium sand and lean brown clay; more sandy from 149 feet. Grades to clean sand at 157 feet.
- 157.0 Sand, fine to medium grained, angular to subround.
- 160.0 Sandy clay, brown, moderately plastic, variable amount of fine sand.
- 166.0 Clay, reddish brown, lean, small amount of very fine sand.
- 174.0 Sand, fine to coarse with a few small gravels, cuttings are angular.
- 182.0 Sandy clay-clayey sand, varying proportions of fine to coarse sand and brown lean clay, few small gravels.
- 198.0 Sand, fine to coarse with few small gravels, angular, clean.
- 207.0 Gravelly clayey sand, fine to coarse sand with about 25 percent gravel up to 1/2 inch size, mostly angular to subangular, 5 to 15 percent clay.
- 213.0 Sandy clay, light brown, lean, fine to medium sand, scattered coarse sand and small gravel.

INCLOSURE 5 SHEET 8

Test Well No. 8 (Cont'd)

- 72.0 Gravelly sand, fine to coarse angular sand with 30 to 40 percent angular to subround gravel, trace of clay.
- 85.0 Sand, fine to coarse, mostly angular scattered small gravel; thin streaks of sandy clay 94.0 to 97.0 feet.
- 97.0 Clayey sand, sand as at 85.0 feet with 5 to 10 percent brick red to brown clay. Clay content decreases below 105 feet.
- 107.0 Sand, fine to medium grained, finer at 116.0 feet, trace of clay. Clay content 5 to 10 percent at 118 feet
- 120.0 Sand as at 107 feet with thin layers of clayey sand, clay content 5 to 15 percent.
- 140.0 Clayey sand-sandy clay, about equal amounts of fine to medium sand and lean brown clay; more sandy from 149 feet. Grades to clean sand at 157 feet
- 157.0 Sand, fine to medium grained, angular to subround.
- 160.0 Sandy clay, brown, moderately plastic, variable amount of fine sand.
- 166.0 Clay, reddish brown, lean, small amount of very fine sand.
- 174.0 Sand, fine to coarse with a few small gravels, cuttings are angular.
- 182.0 Sandy clay-clayey sand, varying proportions of fine to coarse sand and brown lean clay, few small gravels.
- 198.0 Sand, fine to coarse with few small gravels, angular, clean.
- 207.0 Gravelly clayey sand, fine to coarse sand with about 25 percent gravel up to 1/2 inch size, mostly angular to subangular, 5 to 15 percent clay.
- 213.0 Sandy clay, light brown, lean, fine to medium sand, scattered coarse sand and small gravel.

INCLOSURE 5 SHEET 8

Test Well No. 8 (Cont'd)

- 230.0 Sand, fine to coarse, well graded, mostly angular.
- 237.0 Clayey sand grading to sandy clay, fine to coarse sand with increasing amount of light brown clay.
- 252.0 Sand, fine to medium grained, angular.
- 254.0 Clayey sand; sand as at 252 feet with 15 to 30 percent light brown clay.
- 258.0 Sand, fine grained, well sorted, clean.
- 268.0 Clayey sand, fine to medium grained angular sand with variable amounts of lean brown clay, clay content 10 to 40 percent.
- 300.0 Lower Unit of Basin Fill
Sandy clay, light brown, lean, 10 to 40 percent fine to medium sand.
- 305.0 Clayey sand, fine to medium grained sand with highly variable amounts of light brown lean clay, some thin layers of clean sand.
- 360.0 Sand, fine to medium grained, angular, trace to 10 percent brown clay.
- 405.0 Sand, mostly fine grained, slightly coarser below 422.0 feet, angular to subround.
- 445.0 Mostly medium grained sand, trace of clay.
- 497.0 Sand is fine grained, trace to 10 percent brown clay, abundant quartz and feldspar grains give overall medium gray color, slightly cemented.
- 570.0 Sand, fine to medium grained, angular to subround slight increase in darker colored grains, slightly to moderately cemented, cementing increases with depth.
- 600.00 Darker colored grains more abundant with increasing depth, probably reworked Pantano.

Test Well No. 8 (Cont'd)

- 632.0 Pantano Formation
Sand, fine to medium grained, cuttings are mostly fine and angular, probably being ground up, mostly dark colors with a small amount of quartz, overall brown color, moderately cemented, hardness (cementation) continues to increase with depth.
- 685.0 Cuttings are mostly medium grained, angular, +10 percent fine.
- 693.0 Fine to medium coarse, cementation seems to vary as reflected by drilling rate.
- 780.0 Mostly fine grained but probably being ground up by bit.
- 880.0 Cuttings are fine to coarse angular sand (less grinding with new bit). Grain size seems to vary with bit condition and hardness (cementation)
- 1000.0 Overall color is grayish brown, cuttings are fine to medium.
- 1080.0 Cuttings are fine to coarse, angular to subangular
- 1095.0 Gravelly Sand, fine to coarse sand and small gravel, angular to subangular, some gravel particles are fragments of soft shale (Sandy siltstone).
- 1104.0 Sand, fine to coarse, angular to subround, scattered gravel size fragments of light reddish brown sandy siltstone.
- 1220.0 Fine to medium, mostly fine, no gravel sizes.
- 1295.0 Volcanic Conglomerate--(Bronco Volcanics) Drilled with 7-7/8 inch bit. Hole not cased from 1304. Cuttings are fine to coarse sand, mostly medium to coarse, angular to subround, grains are almost all dark colors--dark green, dark gray, brown, maroon, few small grains of calcite, very hard, well cemented.
- 1501.0 Bottom of Well.

INCLOSURE 5, SHEET 10

Fort Huachuca, Arizona
Geologic Log
Observation Well - Site 8

- 0.0 Terrace deposits
Sandy clay, light reddish brown, lean clay, dry,
contains a large percent of fine sand.
- 1.0 Clayey sand, reddish brown, very fine and medium
grained, angular sand (skip graded), 40 to 60 percent
reddish clay.
- 3.0 Clayey sand, reddish brown, fine to coarse grained,
but mostly medium to coarse, angular, about 10 to 15
percent lean clay.
- 12.0 Sand, reddish brown, mostly fine to medium grained,
angular, small amount of reddish clay.
- 15.0 Sand is fine to coarse, angular.
- 24.0 Upper Unit of Basin Fill
Sand, medium to coarse, slightly cemented.
- 30.0 Sand is medium grained, angular, cemented.
- 40.0 Sand is fine to medium grained, few rounded grains,
small amount of clay.
- 43.0 Clayey sand, very fine to fine grained, 25 to 35
percent reddish brown clay.
- 46.0 Sand, very fine to fine grained, appears to be clean,
partly cemented slightly.
- 75.0 Clayey sand, medium to coarse sand and scattered
gravel up to 1/2-inch size, 10 to 15 percent clay.
- 84.0 Silty gravelly sand, medium to coarse sand with few
small gravels and 15 to 20 percent silt or lean clay.
- 96.0 Sand alternating with sandy clay; mostly medium
grained sand with varying percent lean clay or silt,
mottled brick red and brown.
- 104.0 Sand, fine to medium grained, angular to subround,
5 to 10 percent reddish brown silt. Sand gets finer
with depth.

Observation Well - Site 8 (cont'd)

- 115.0 Sand is very fine to fine grained, appears to be clean.
- 148.0 Sandy clay, brown, firm, small amount of fine to medium sand.
- 151.0 Sand, fine to coarse but mostly medium, few gravels up to 1/2-inch size.
- 160.0 Sandy gravel, subround to angular gravel up to 3/4-inch size, about 20 percent medium to coarse sand, clayey near bottom.
- 175.0 Sandy clay, brown, firm, small amount of fine to medium sand.
- 178.0 Sandy gravel, subround to angular gravel up to 3/4-inch size, about 20 percent medium to coarse sand.
- 187.0 Gravelly sandy clay, brown, lean clay with about 25 percent sand and gravel up to 3/4-inch size.
- 192.0 Clayey sandy gravel, angular to subround gravel up to 3/4-inch size with about 15 percent lean brown clay.
- 204.0 Sandy gravel, coarse sand and gravel up to 3/4-inch size, angular to subround.
- 210.0 Gravelly clay, brown, lean, sandy clay with 30 to 40 percent angular to subround gravel up to 1/2-inch size.
- 225.0 Clayey gravel - gravelly clay, clay and gravel as at 210.0 feet in variable proportions.
- 243.0 Clayey gravel as at 225.0 feet, 10 to 20 percent lean borrow clay, cobbles 243.0 to 247.0 feet.
- 253.0 Sandy clay, brown, firm, 10 to 15 percent fine to coarse sand, few small gravels. Gravel content increases at 255 feet, up to 40 percent.
- 255.0 Gravelly sandy clay, brown, firm, gravel content highly variable, sand mostly fine or coarse (gravel and coarse sand in a sandy clay matrix).

Observation Well - Site 8 (cont'd)

- 285.0 Lower Unit of Basin Fill
Sandy clay, brown to light gray, lean, low percent fine sand, scattered gravel and coarse sand grains.
- 318.0 Sandy clay as above but sand content highly variable --
+ 5 to 30 percent
- 345.0 Sandy clay-clayey sand, about equal amounts of lean brown clay and fine to medium sand, few coarse grains.
- 360.0 Clayey sand, mostly medium grained, small amount is fine grained, 10 to 15 percent lean brown clay.
- 380.0 Sand, fine to medium grained, streaks of brown clay, overall 5 to 10 percent clay.
- 400.0 Clayey sand, fine and coarse sand (skip graded) with 15 to 25 percent brown clay. Clay content increase to almost 50 percent at - 410 feet.
- 413.0 Sandy clay, grayish brown, 30 to 40 percent grayish brown clay.
- 446.0 Sand, fine to medium grained, few coarse grains, cemented.
- 468.0 Bottom of observation well

Fort Huachuca, Arizona
Geologic Log
Test Well No. 9

- 0.0 Terrace deposits
Gravelly clayey sand, reddish brown; sand is fine to coarse but mostly coarser sizes, angular to subround; gravel is mostly fine, angular to rounded, + 25 to 40 percent reddish brown clay.
- 5.0 Clayey sand, reddish brown, sand is fine to medium grained, angular to subround, 30 to 40 percent reddish brown clay.
- 16.5 Clayey sand as above but clay content is 5 to 10 percent.
- 24.5 Clay content estimated 30 percent.
- 26.5 Clay content estimated 5 to 10 percent
- 33.5 Sand, mostly medium grained, high percent of quartz grains, trace of clay.
- 34.5 Sand is clean, mostly quartz, angular to rounded.
- 39.0 Upper Unit of Basin Fill
Sand, fine to medium, angular to subround, overall brown color, trace of reddish brown clay.
- 56.5 Sand is moderately cemented, fine grained.
- 66.0 Sand contains 5 to 10 percent reddish brown clay.
- 74.0 Sand, fine to coarse, angular to rounded, gradation varies (well graded to poorly graded), clean.
- 85.0 Sand, mostly medium and coarse, contains a small amount of clay at 85.0 feet, increase to 10 to 15 percent at 90.0 feet.
- 90.0 Clayey Sand--sandy clay, probably in alternating layers, light brown and light gray sandy clay alternating with medium to coarse sand, gray clay is limey.

INCLOSURE 5 SHEET 14

Test Well No. 9 (Cont'd)

- 107.0 Clay, light brown, soft, moderately plastic, small amount of fine to medium sand as thin streaks.
- 110.0 Color alternates from light greenish gray to light brown.
- 150.0 Color is mixed light gray (almost white) and light brown, no more than 5 percent fine sand.
- 170.0 Clayey sand, fine to medium, angular to subround, low percent brown clay at 170.0 feet, increase to \pm 25 percent at 179.0 feet.
- 188.0 Sand, fine to medium grained, angular to subround less than 5 percent brown clay.
- 194.0 Clayey sand, sand as at 188.0 feet with about 25 percent brown clay at 194.0 feet; clay content varies from about 10 to 30 percent.
- 255.0 Sandy clay, brown, soft, moderately plastic contains about 30 to 35 percent fine to coarse sand.
- 265.0 Clay, brown, stiff, highly plastic, very small amount of fine sand.
- 308.0 Color change to dull maroon.
- 317.0 Thin streak is sandy, color change to brown.
- 340.0 Clay contains 5 to 10 percent fine sand and scattered small angular gravels.
- 370.0 Lower Unit of Basin Fill
Clayey sand, brown, sand fine to coarse, mostly medium to coarse, scattered angular pea gravel, \pm 30 percent lean clay.
- 380.0 Thin streak of clean sand.
- 382.0 Clay content varies from 5 to 20 percent.
- 398.0 Thin streaks of clean sand from 398.0 to 400.0 feet.
- 400.0 Clayey sand, fine to coarse, angular to subround, clay content varies from about 10 to 30 percent.

INCLOSURE 5 SHEET 15

Test Well No. 9 (Cont'd)

- 478.0 Sandy clay, brown, moderately plastic, 5 to 10 percent fine to medium grained sand.
- 500.0 Clay, brown, moderately plastic, contains less than 5 percent fine to medium sand.
- 598.0 Clayey sand, fine to coarse, mostly medium to coarse, angular to subround, about 5 percent brown clay, some evidence of cementation.
- 600.0 Pantano Formation
Sand, fine to coarse, angular to subround, mostly darker colors, some gray granitic rock and white quartz, slightly cemented, hardness and cementation increase with depth; contains a small amount of interstitial clay.
- 620.0 Sand, fine to coarse, angular to subround, less than 5 percent brown clay.
- 740.0 Gravelly sand, fine to coarse, angular to subangular sand and 1/4 to 3/8-inch gravel, few flat pieces of soft brown shale (claystone), 30 to 50 percent gravel, trace of brown clay.
- 780.0 Gravel content is no more than 15 percent
- 800.0 Sand, fine to coarse, mostly angular, scattered small gravels, trace of brown clay, slightly cemented.
- 840.0 Sand is mostly medium to coarse, scattered small gravels.
- 920.0 Sand is fine to medium, few coarse grains, angular to subangular, trace of brown clay, slightly to moderately cemented.
- 935.0 Sand is fine to coarse, angular to subangular, trace of brown clay.
- 964.0 Sand contains numerous fragments of brown shale.
- 1005.0 Bottom of hole.